



# Economic Impacts of Sanitation in Southeast Asia Summary

A four-country study conducted in  
Cambodia, Indonesia, the Philippines and Vietnam  
under the Economics of Sanitation Initiative (ESI)

Water and Sanitation Program - East Asia and the Pacific (WSP-EAP)  
World Bank  
East Asia and the Pacific Region

November 2007



# Contents

ACKNOWLEDGEMENTS	1
EXECUTIVE SUMMARY	3
1. INTRODUCTION	5
2. METHODS	7
2.1 STUDY APPROACH	7
2.2 SCOPE OF 'SANITATION'	7
2.3 IMPACTS EVALUATED	8
2.4 IMPACT MITIGATION	8
3. RESULTS	9
3.1 HEALTH IMPACTS	9
3.2 WATER IMPACTS	12
3.3 ENVIRONMENTAL IMPACTS	16
3.4 OTHER WELFARE IMPACTS	17
3.5 TOURISM IMPACTS	19
3.6 OVERALL ECONOMIC IMPACTS	20
4. RECOMMENDATIONS	22
ANNEX	23
ABBREVIATIONS	23
Tables	
Table 1. Aspects of sanitation included and excluded in the study	7
Table 2. Features of sanitation interventions for assessing economic gains	8
Table 3. Health impacts of poor sanitation included and excluded	11
Table 4. Total annual release of human excreta and household waste water to inland water bodies	12
Table 5. Water quality indicators for selected polluted surface water bodies	13
Table 6. Water impacts of poor sanitation included and excluded	14
Table 7. Unit prices of alternative water sources, and proportion of households treating water	14
Table 8. Fish catch value - actual and estimated loss (US\$ million)	15
Table 9. Indicators of latrine conditions and access (millions), latest data	17
Table 10. Economic impact of lower tourist numbers	19
Table 11. Economic costs in US Dollars, International Dollars and compared with GDP	21
Figures	
Figure 1. Improved sanitation coverage in Southeast Asia - MDG indicator, 2004 (%)	5
Figure 2. Total annual disease episodes and deaths	9
Figure 3. Distribution of episodes by disease (4 countries)	10
Figure 4. Distribution of deaths by cause (4 countries)	10
Figure 5. Annual per capita health-related economic costs of poor sanitation (US\$)	10
Figure 6. Annual per capita water-related economic costs of poor sanitation (US\$)	15
Figure 7. Perceived importance of improved latrine to households in Cambodia	18
Figure 8. Overall annual economic losses and gains (in US\$ million)	20
Figure 9. Annual per capita losses, by impact (US\$)	20
Figure 10. Distribution of economic gains from improved sanitation, by impact	21



# Acknowledgements

The Sanitation Impact Study was conducted in Cambodia, Indonesia, the Philippines and Vietnam. A study is ongoing in Lao PDR. The study was led by the East Asia and Pacific office of the World Bank's Water and Sanitation Program (WSP), with the contribution of WSP teams in each of the participating countries. The study took one year to complete, and has undergone two major peer review processes. This summary report is based on four full-length country reports and a full-length synthesis report (see CD-Rom in this publication, inside the back cover).

Guy Hutton (WSP-EAP Regional Senior Water and Sanitation Economist) led the development of the concept and methodology for the Economics of Sanitation Initiative, and the management and coordination of the country teams. The study benefited from the continuous support of other WSP-EAP staff. Isabel Blackett was the Task Team Leader; and Jema Sy, Brian Smith, Almud Weitz and Richard Pollard provided input to the concept development and study execution. Bjorn Larsen (WSP Consultant) contributed to the study methodology and provided the figures for malnutrition-related health effects of poor sanitation.

## The country teams were composed of:

**Cambodia:** Economics Institute of Cambodia  
Phyrum Kov (country lead), Hach Sok (EIC Director),  
Sophannara Roth and Kongkea Chhoeun.

**Indonesia**  
Lydia Napitupulu (country lead) and Dedek Gunawan.

**Philippines**  
U-Primo E. Rodriguez (country lead) and Nelissa Jamora.

**Vietnam**  
Pham Ngoc Thang (country lead) and Hoang Anh Tuan.

WSP staff in country offices that provided valuable management, technical support and peer review were Jan Willem Rosenboom (WSP Cambodia), Thomas Meadley (WSP Lao PDR), Edkarl Galing and Leila Elvas (WSP Philippines), and N Thanh, Mike Seager, Nguyen Diem Hang and Nga Kim Nguyen (WSP Vietnam).

Elena Strukova, Caroline van den Berg, Anjali Archarya, and Tracey Hart reviewed the methodology study before its implementation. Peer reviewers of the synthesis draft report were (World Bank staff unless otherwise stated): Eddy Perez, Anjali Acharya, Pete Kolsky, Elena Strukova (consultant), Bjorn Larsen (consultant), and Peter

Feldman (Plan International).

Peer reviewers of the Cambodia country draft report were: Hilda Winarta (UNICEF), Jan Lam (SNV), Chea Samnang (Ministry of Rural Development), Ruud Corsel (Niras-Scanagri, Vietnam), and Oun Syvibola (Plan International). Peer reviewers of the Philippines country draft report were: Jema Sy and Andy Robinson (consultant). Peer reviewers of the Vietnam country draft report were: Samuel Leibermann, Doan Hong Quang, Pham Khanh Toan (Ministry of Construction), Nguyen Viet Anh (University of Civil Engineering), Nguyen Kim Thai (University of Civil Engineering), Nguyen Van Thuan (Australian Agency for International Development), and John Collett (Plan International).

In conducting the study, a wide range of experts and stakeholders provided valuable input, which WSP and the country consultants appreciate greatly. The stakeholders are acknowledged in the country reports.

The ESI has been financed by the regional component of the Sustainable Sanitation in East Asia (SUSEA) program, which is funded by the Swedish International Development Agency (SIDA).

The Philippines study received co-funding from the United States Agency for International Development (USAID) Environmental Cooperation-Asia (ECO-Asia) Water and Sanitation program. WSP and the report authors are grateful to the funding agencies for supporting this study.

## Reference for citation:

Economic impacts of sanitation in Southeast Asia: summary report. Hutton G, Rodriguez UE, Napitupulu L, Thang P, Kov P. World Bank, Water and Sanitation Program. 2007.

Summary reports are available for each country. Full-length country reports are available as follows:

Economic impacts of sanitation in Cambodia. Kov P, Sok H, Roth S, Chhoeun K, Hutton G. World Bank, Water and Sanitation Program. 2007.

Economic impacts of sanitation in Indonesia. Napitupulu L and Hutton G. World Bank, Water and Sanitation Program. 2007.

Economic impacts of sanitation in the Philippines. Rodriguez UE, Jamora N, Hutton G. World Bank, Water and Sanitation Program. 2007.

Economic impacts of sanitation in Vietnam. Thang P, Tuan H, Hang N, Hutton G. World Bank, Water and Sanitation Program. 2007.

Table of Basic Country Data

Variable	Cambodia	Indonesia	Philippines	Vietnam
Population				
Total population (millions)	13.8	221.8	84.2	84.2
Rural population (%)	83.8%	59.2%	65.4%	74.0%
Urban population (%)	16.2%	40.8%	34.6%	26.0%
Annual population growth	1.9%	1.0%	2.4%	1.0%
Under 5 population (% of total)	12.3%	10.8	12.6%	8.9%
Under 5 mortality rate (per 1,000)	83	36	33	19
Female population (% of total)	51.5%	50.2%	49.6%	51%
Population below poverty line	35%	27%	37%	29%
Currency				
Currency name	Riel	Rupiah	Peso	Dong
Year of cost data presented	2005	2006	2005	2005
Currency exchange with US\$	4,050	8,828	55.1	16,080
GDP per capita (US\$)	447	1,420	1,282	690
Sanitation				
% improved rural	15.7%	40%	59%	50%
% improved urban	56.1%	73%	80%	92%
% urban sewage connection treated	28.9%	2.0%	3.3%	14.0%

# Executive Summary

Sanitation is a neglected aspect of development in countries where spending is limited, and where many other priorities crowd the agenda. Sanitation coverage has increased gradually as economic growth has spread to Asia's poorer countries. However, hundreds of millions of people in the region still lack access to improved sanitation, which is seen more as a result, rather than a cause, of economic growth. Few governments and households identify poor sanitation as an impediment to economic growth.

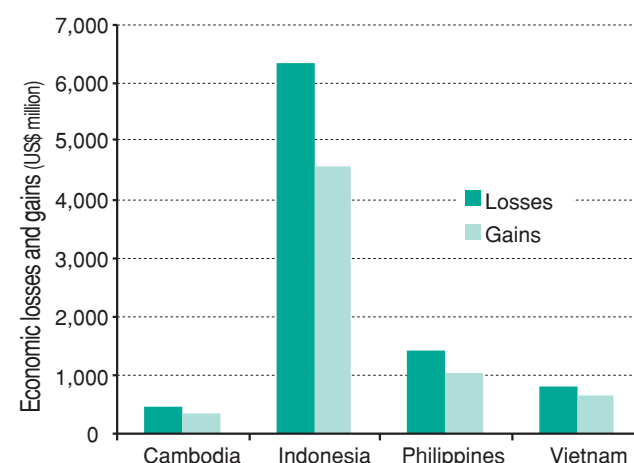
This study examines the major health, water, environmental, tourism and other welfare impacts associated with poor sanitation in Cambodia, Indonesia, the Philippines and Vietnam. By examining the economic impacts of poor sanitation, and the potential gains from improved sanitation, this study provides important evidence to support further investments in sanitation. The goal of this report is to show decision-makers at the country and regional levels how the negative impacts of poor sanitation can be mitigated by investing in improved sanitation.

The study is based on evidence from other investigations, surveys and databases. The impact measurement reported in the study focuses mainly on a narrow definition of sanitation - human excreta management and related hygiene practices. The measurement of water resource impact included release of gray water to water bodies, and the measurement of environmental impact included poor solid waste management.

Cambodia, Indonesia, Vietnam and the Philippines lose an estimated US\$9 billion a year because of poor sanitation (based on 2005 prices). That is approximately 2% of their combined Gross Domestic Product (GDP), varying from 1.3% in the Philippines and Vietnam, to 2.3% in Indonesia and 7.2% in Cambodia. The annual economic impact is

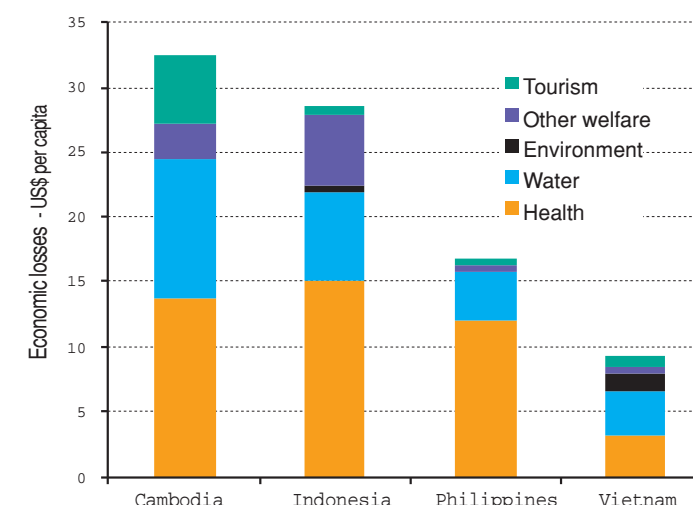
approximately US\$6.3 billion in Indonesia, US\$1.4 billion in the Philippines, US\$780 million in Vietnam and US\$450 million in Cambodia. With the universal implementation of improved sanitation and hygiene, it is assumed that all the attributed impacts are mitigated, except health, for which 45% of the losses are mitigated. Universal sanitation would lead to an annual gain of US\$6.3 billion in the four countries, as shown in the figure below. The implementation of ecological sanitation approaches (fertilizer and biogas) would be worth an estimated US\$270 million annually.

Overall annual economic losses from poor sanitation and gains from universal sanitation (in US\$ million)



Annual per capita losses range from US\$9.30 in Vietnam, to US\$16.80 in the Philippines, US\$28.60 in Indonesia to a high of US\$32.40 in Cambodia.

Annual per capita losses, by impact (US\$)



The four countries in this study have a total 400 million people. Health resources contribute most to their overall losses. Poor sanitation, including hygiene, causes at least 180 million disease episodes and 100,000 premature deaths annually. The resulting economic impact from health alone is more than US\$4.8 billion a year, divided between US\$3.3 billion in Indonesia, US\$1 billion in the Philippines, US\$260 million in Vietnam and US\$190 million in Cambodia.

Poor sanitation also contributes significantly to water pollution – adding to the cost of safe freshwater for households, and reducing the production of fish in rivers and lakes. The associated economic costs of polluted water attributed to poor sanitation exceed US\$2.3 billion per year, divided between US\$1.5 billion in Indonesia, US\$320 million in the Philippines, US\$290 million in Vietnam and US\$150 million in Cambodia. Poor sanitation also contributes to US\$220 million in environmental losses (loss of productive land) in Indonesia and Vietnam, US\$1.3 billion in other welfare losses (time to access unimproved sanitation), and US\$350 million in tourism losses

This is the first regional study to compile economic evidence on a

range of impacts of poor sanitation. The economic results are a wake-up call to governments and the development community. Poor sanitation affects everyone, but especially the poor and vulnerable (children, women, disabled and senior people). The considerable socio-economic importance of sanitation shown in this study, and the key links improved sanitation has with other development goals (poverty and hunger reduction, gender equality, child health, access to safe drinking water, and quality of life of slum-dwellers) demonstrates that sanitation should receive far greater attention from governments and other development partners whose interest is the equitable socio-economic development of countries of East and Southeast Asia. Decision-makers should act now and in a concerted way to increase access to improved sanitation and hygiene practices.



ISSDP for WSP



# Introduction

Asian nations are on a development path that is lifting large numbers of people out of poverty and improving access to goods and services that improve quality of life. However, an economic development model that prioritizes economic growth risks ignoring environmental degradation, which affects health and resource productivity. Modest government and household budgets generally neglect services needed by low-income groups and those with a limited political voice.

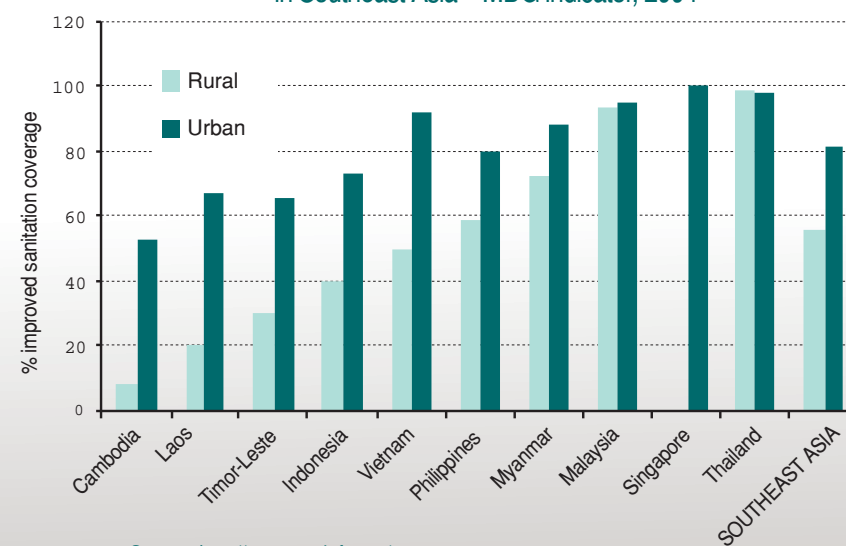
Sanitation is one such neglected aspect of development. In countries where the public purse is severely limited and population needs seemingly boundless, sanitation is not deemed attractive or important enough to gain the attention of politicians or journalists. It is often seen as a 'private matter' to be handled by the household or local community. Also, institutionally, sanitation is sidelined by lack of clear ministerial responsibilities.

However, the tide is changing for sanitation. In 2002, the United Nations made sanitation a Millennium Development Goal (MDG) target and designated 2008 the International Year of Sanitation. While sanitation is usually more broadly defined as the "hygienic disposal or recycling of waste", the new MDG target narrows the definition to access to an improved household latrine.

Figure 1 presents improved household sanitation coverage in Southeast Asian countries, showing rural sanitation far behind urban sanitation. In 2004, improved sanitation varied from a regional low of 17% in Cambodia to nearly 100% in Singapore and Thailand. The same year, 183 million people in Southeast Asia lacked access to an improved household latrine. At the current rate of progress, several countries will fall short of the 2015 MDG sanitation target. In addition, good hygiene – especially hand washing with soap following defecation – is not widely practiced.

If sanitation is to become a higher priority for governments and households, evidence is needed that measures its socio-economic importance and ties it to other MDG's, including gender equality, the reduction of hunger and poverty, the improvement of child health, access to safe drinking water and slum-dwellers' quality of life.

Figure 1.  
Improved sanitation coverage  
in Southeast Asia – MDG indicator, 2004



Source: <http://www.wssinfo.org/>

<sup>1</sup> Target 10 is to "halve by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation". Improved sanitation according to WHO / UNICEF Joint Monitoring Programme is:  
<sup>(1)</sup> flush or pour-flush to piped sewer system, septic tank or pit latrine; or  
<sup>(2)</sup> Ventilated Improved Pit-latrine; or <sup>(3)</sup> pit latrine with slab; or  
<sup>(4)</sup> composting toilet.

This study was conducted in Cambodia, Indonesia, the Philippines and Vietnam under the WSP-EAP Economics of Sanitation Initiative (ESI). It aims to compile and generate evidence on the following aspects:

Economic impacts of poor sanitation on health, water and the environment.

The links between sanitation and broader human activities, such as education, productivity, and tourism.

Population preferences concerning latrine options and environmental sanitation, and their contribution to quality of life.

How much improved sanitation can alleviate these burdens and generate economic savings to society and improve quality of life.

The target audience of ESI is primarily national-level policy makers with influence over the allocation of resources to sanitation, including central ministries (e.g., prime minister's office, planning, budgeting, economics, finance), line ministries (e.g. infrastructure/construction, health, water, environment, rural development, urban planning) and external funding partners (multilateral, bilateral and non-government agencies). The study is also targeted at sub-national decision-making levels where its results and conclusions are also relevant, particularly in a decentralized environment.

Almud Weitz



# Methods

## 2.1 Study approach

This study follows a standardized peer reviewed methodology. While the primary aim is to provide national estimates of the economic impact of poor sanitation, results are also presented at regional or provincial level in the country reports<sup>2</sup>. as well as by rural/urban, gender, and age breakdown where feasible.

The study uses a modeling approach, drawing almost exclusively on existing studies and survey data from official sources. It presents impacts in primary units of measurement (e.g. disease episodes, water quality), and converts these to monetary equivalents using conventional economic valuation techniques where possible. Economic impacts are presented in US Dollars (US\$) for a single year, 2005. Some impacts are examined and reported descriptively.

<sup>2</sup> See country report references in Acknowledgements section

<sup>3</sup> In Vietnam, a broader definition of sanitation was applied for water impacts, including agricultural waste, storm water, and cottage industries. Results presented here reflect only the narrower definition.

Table 1. Aspects of sanitation included and excluded in the study

Included	Excluded
Human excreta management:	Drainage and general flood control
Quality, safety and proximity of latrine	Industrial, trade village and medical waste
Safe isolation, disposal, conveyance, treatment	Vector control
Hygiene practices	Broader food safety
Gray water management	Other agricultural waste
Household solid waste management	Broader environmental sanitation
Animal excreta management (Cambodia and Vietnam) and agricultural waste (Vietnam)	

## 2.2 Scope of ‘sanitation’

Lack of access to improved latrines is the principal aspect of unimproved sanitation evaluated in the study (see Footnote 1). The impacts of poor hygiene practices, gray water and solid waste management at the household level are also evaluated. Animal excreta is included in Cambodia and Vietnam<sup>3</sup>.

Table 1 shows the aspects included and excluded in the study. The excluded aspects also have considerable economic, environmental and population welfare impacts, and merit detailed study.

## 2.3 Impacts evaluated

Poor sanitation has many actual or potentially negative impacts on populations and national economies. The study focuses on five impacts because of their importance and/or amenability to analysis using credible information and data sources:

- Health impacts
- Water resource impacts
- Environmental impacts (focusing on the outdoor environment)
- Other welfare impacts (focusing on preferences for latrine type)
- Tourism impacts

The estimated economic losses of these impacts include additional expenditures, income or productivity losses, and the value of premature death associated with poor sanitation. Non-pecuniary welfare impacts

were assessed, but not quantified in monetary units. When other factors impacted an evaluated sector, economic losses were estimated based on the narrower definition of poor sanitation (See Table 1).

## 2.4 Impact mitigation

From a policy viewpoint, it is important to know how much the estimated losses resulting from poor sanitation can be reduced by implementing improved sanitation options. For some impacts such as health, improved sanitation and hygiene do not totally solve the problem, so the overall estimated losses cannot be fully mitigated.

This study estimates the potential benefits of certain features of sanitation improvements. It provides an initial estimate of the likely gains from improving these features (see Table 2). ESI's second study aims to estimate the costs and benefits of specific sanitation technical and management approaches.

Table 2. Features of sanitation improvement for assessing economic gains

Intervention	Detail	Gains evaluated
Making toilets cleaner and safer	Improved: position or type of toilet seat or pan; structure; collection system; ventilation; waste evacuation	Avert health impacts (32% reduction)
Hygiene	Availability of water for anal cleansing; safe disposal of materials for anal cleansing; hand washing with soap; toilet cleaning	Avert health impacts (45% reduction)
Latrine access	Toilets closer and more accessible (private rather than shared or public)	Save latrine access time
Isolation of human waste from water resources	Improved: septic tank functioning and emptying; flood-proof; treatment; drainage system	Avert costs of accessing clean water for drinking and other household uses; avert losses to fish production
Sanitary conditions for tourists	Culturally appropriate improved tourist toilet facilities (hotel, restaurants, tourist attractions) and general sanitary conditions	Avert tourist losses
Re-use of human waste	Composting of feces for fertilizer; biogas production	Value of replaced fertilizer and fuel



# Result

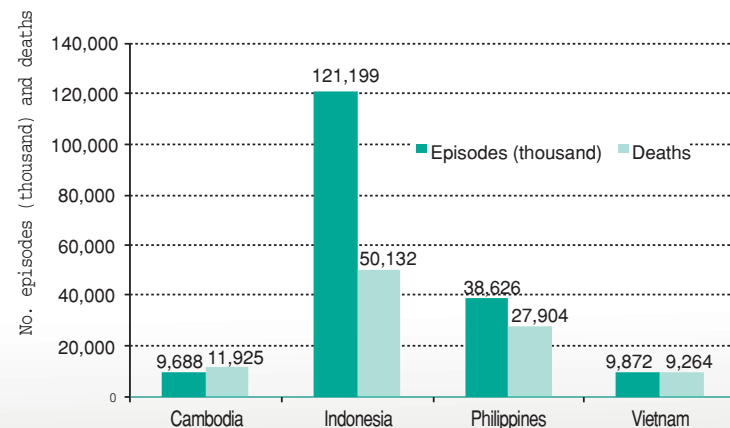
## 3.1 Health impacts

Poor sanitation causes substantial illness and premature death, especially in younger age groups. Figure 2 shows the estimated number of episodes and deaths attributed to poor sanitation for selected diseases in the four countries. The main contributors to disease burden are shown in Figure 3 (episodes) and Figure 4 (deaths). Of the diseases included, diarrhea-related diseases account for 80% of episodes and 48% of premature deaths. Skin disorders are an important contributor to disease episodes, due to the high number attributed to poor sanitation and hygiene in Indonesia (29 million annually). Helminthes, parasitic worms, account for 1% of total sanitation-related episodes, reflecting Indonesia and Vietnam only. Trachoma, chronic contagious bacterial conjunctivitis that can lead to blindness, is particularly important in Vietnam where 865,000 cases were reported. Lack of routine and good quality data hampered the inclusion of all disease episodes and deaths attributed to poor sanitation (Table 3).



ISSDP for WSP

Figure 2. Total annual disease episodes and deaths attributed to poor sanitation



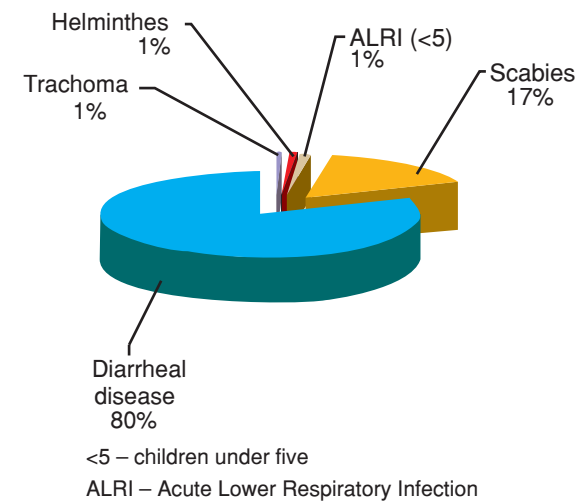
Poor sanitation, through its important implications for child nutritional status, is associated with higher rates of acute lower respiratory infection (ALRI) and malaria, as well as increased mortality from a range of childhood diseases. This study has drawn on other recent evidence that shows the importance of indirect cases of morbidity and premature mortality<sup>4</sup>. A high proportion of children under 5 are reported to be malnourished. Low weight-for-age is reported in 36% of children under 5 in Cambodia, 28% in Indonesia and the Philippines, and 22% in Vietnam. Episodes of ALRI attributed to poor sanitation annually exceed 2 million. Indirect deaths attributed to poor sanitation are in excess of 50,000 per year (Cambodia 5,500, Indonesia 26,000, Philippines 14,500, Vietnam 5,000)<sup>5</sup>. These deaths are caused by ALRI (16,000), measles (6,100), malaria (3,700) and other factors<sup>6</sup> (24,000).

<sup>4</sup> World Bank 2007 (forthcoming), "Environmental Health and Child Survival: Epidemiology, Economics, Experiences," Environment and Development Series 3. World Bank: Washington DC.

<sup>5</sup> Note that these figures include some indirect causes not presented in the country reports (protein energy malnutrition and 'other' indirect causes).

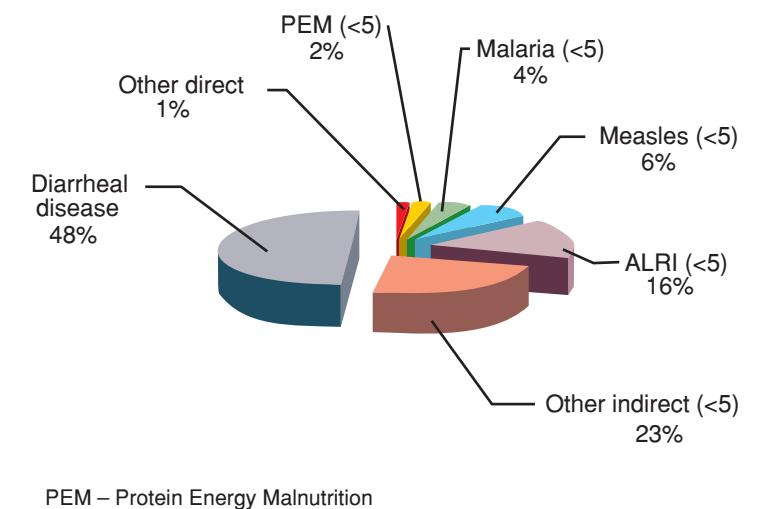
<sup>6</sup> These consist, among others, of TB, other childhood cluster diseases, meningitis, hepatitis, dengue fever, protein energy malnutrition, and residual deaths (not assigned to other causes).

Figure 3. Distribution of episodes by disease (4 countries)



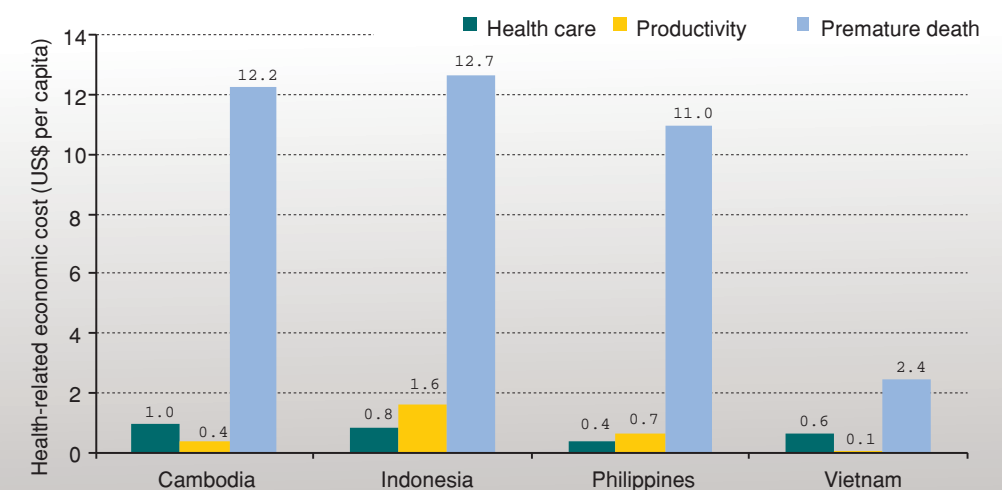
Fishman S, Caulfield L, de Onis M, Blössner M, Hyder A, Mullany L and Black R. Childhood and Maternal Underweight. In "Comparative Quantification of Health Risks: Global and Regional Burden of Disease due to Selected Major Risk Factors." 2004. Ezzati M, Rodgers A, Lopez A and Murray C (Editors).

Figure 4. Distribution of deaths by cause (4 countries)



Diseases resulting from poor sanitation impact expenditure patterns, productivity and the income of households, governments, and enterprises. Figure 5 shows the quantified economic impacts of selected diseases. Overall, US\$4.8 billion is lost annually to sanitation-related diseases, of which US\$3.35 billion (70%) is lost in Indonesia, US\$1 billion (21%) in the Philippines, US\$260 million (5%) in Vietnam, and US\$187 million (4%) in Cambodia. Figure 5 shows the annual per capita health-related economic costs. The major contributor to economic cost is premature death, mainly of children under 5. Premature death is valued as the individual's discounted sum of future earnings, which is called the 'human capital approach' (HCA). Sanitation-related diseases also impact quality of life, causing pain, discomfort, reduced capacity to socialize and undertake normal activities, and grief, all of which are hard to value in monetary terms and not included in the US\$4.8 billion cost.

Figure 5. Annual per capita health-related economic costs of poor sanitation (US\$)



Improved sanitation will help mitigate these estimated economic costs. The size of losses averted depends on the type and efficiency of the interventions. To reduce the disease impacts, improved sanitation should be combined with other policies such as improved early treatment and child feeding programs. Sanitation programs implemented alone have been found to reduce disease rates by an average 32%, while hygiene programs have been found to reduce disease incidence by 45%<sup>7</sup>. Hence, sanitation and hygiene improvements could reduce health-related costs by US\$1.5 billion and US\$2.2 billion, respectively. These figures are conservative given that several other known health impacts of poor sanitation were excluded in this study.

Table 3. Health impacts of poor sanitation included and excluded

Health impacts included	Health impacts excluded
Health care, health-related productivity and premature mortality costs associated with diarrheal diseases, scabies, and diseases indirectly related to sanitation through malnutrition for children under five. Helminthes, trachoma and hepatitis were included in Indonesia and Vietnam studies only. Direct costs of treatment of malnutrition were included in Cambodia study only.	Health-related quality of life, direct costs of treating malnourished children, reproductive tract infections for women bathing in dirty water, health problems suffered by people working closely with waste products, education impacts of childhood malnutrition, food poisoning from contaminated fish, animal and insect vectors of disease, animal health related to human sanitation, and avian flu.

<sup>7</sup> Fewtrell L, Kaufmann R, Kay D, Enanoria W, Haller L and Colford JJ. Water, sanitation, and hygiene interventions to reduce diarrhea in less developed countries: a systematic review and meta-analysis. *Lancet Infectious Diseases* 2005; 5(1): 42-52.



### 3.2 Water impacts

Statistics show Cambodia, Indonesia, the Philippines and Vietnam all have abundant internal freshwater resources per capita. Despite this, all suffer from significant freshwater pollution from human activities. Table 5 shows the total annual release of human excreta to water bodies, which generates 3.5 million tons of biological oxygen demand (BOD). Many households dispose of wastewater and solid waste in water resources. In Vietnam, 13% of households dispose of solid waste to water courses.

Table 4. Total annual release of human excreta and household wastewater to inland water bodies

Region	Total release (volume)			Biological Oxygen Demand (tons)	Percent contribution of household sources to total BOD release in water resources
	Feces ('000 tons)	Urine ('000 m3)	Gray water (million m3)		
Cambodia	85	852	3	181,500	65%
Indonesia	6,406	64,059	8,541	2,137,000	30%
Philippines	4,237	33,900	1,962	762,000	33%
Vietnam	2,275	22,754	610	357,500	40%
Total	13,003	121,565	11,116	3,438,000	-

The study of water quality focuses almost exclusively on surface waters, particularly the main rivers and lakes. The data shows considerable regional variation in water pollution, with downstream and densely populated areas having the worst pollution. Table 6 presents BOD, total suspended solids (TSS) and dissolved oxygen (DO) statistics on some of the most polluted water resources. In some cases, the same location showed considerable variability at different times. The contribution of domestic sources (gray water, sewage) to overall water pollution varies considerably within and between countries<sup>8</sup>.

<sup>8</sup> Other sources include offices, medical establishments, small industry (e.g. garments, washing, brewery), manufacturing industries (production or processing), chemical fertilizers and pesticides, animal excreta, soil in water courses, silt release from build-up behind dams and salinity intrusion in coastal areas.



Table 5. Water quality indicators for selected polluted surface water bodies

Country, river (location)	Water quality measure (mg/L)		
	BOD1	TSS2	DO3
Cambodia			
Tonlé Sap River (wet season) (Phum Prek)	-	120	3.4
Mekong River (Chroy Changva)	-	175	5.5
Tonlé Sap Lake	-	661	6.5
Indonesia			
Air Bengkulu River (Bengkulu)	1-20	24.2-156	1.1-4.1
Ciliwung River (Jakarta)	1-47	7-59	0-5.8
Citarum River (W. Java)	8-34	75-3220	0-5.9
Brantas River (E. Java)	110-268	20-98	0-8.3
Philippines			
Meycauayan River (Region 3)	119.8	-	1.2
Parañaque River (NCR)	29.5	-	1.5
San Juan River (NCR)	33.5	-	2.4
Pasig River (NCR)	24.2	-	2.4
Vietnam			
Hong River (Red River Delta)	6-91	16-635	0.1-4.78
Day River (Red River Delta)	37	29	1.09
Thi Vai River (South East)	880	-	< 0.5

It is useful to compare these data with country standards. For example, in Vietnam: <sup>1</sup> BOD less than 25 mg/L; <sup>2</sup> TSS less than 80 mg/L; <sup>3</sup> DO greater than 5 mg/L.

Major categories of water use include household activities (e.g., drinking water, washing, personal hygiene, cleaning); crop, livestock and fish production; energy production; industry; transport and recreation. This study focuses on household use and fish production, for which good quality water is important.

Table 6. Water impacts of poor sanitation included and excluded in the study

Water impacts included	Water impacts excluded
Household uses (drinking water, other uses), and freshwater fish production	Household time spent treating drinking water; economic losses of flooding from lack of drainage; polluted surface water may lead to unsustainable extraction of groundwater; intangible benefits of water resources; wildlife use of water resources; unrecorded marketed freshwater fish; marine fish; subsistence fishing losses; nutrient losses from less fish capture and effect on spending

Households are known to use one or more of several mitigation strategies when local water sources are polluted. The price of water per cubic meter from different sources is presented in Table 7. The ranges reflect rural-urban differences. For many households, especially in urban areas, pipelines supply water, which is usually purchased on a metered basis. This is generally the preferred option, as it costs less than other mitigation options such as bottled water or water sold by vendors. Piped water is most common in the Philippines (89% of households). Indonesia has the highest rate of vendor-supplied or

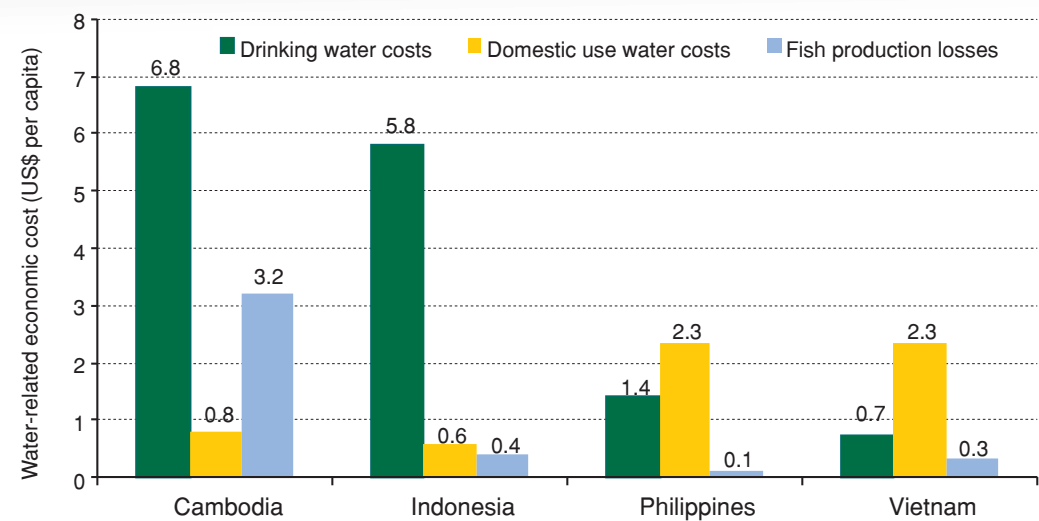
bottled drinking water (5.2% of households). In all countries, rainwater harvesting is common in the rainy season and reduces the need for buying water. A significant proportion of households are reported to treat their water before drinking (from 44% in the Philippines to 90% in Indonesia). This adds considerably to the cost of water for drinking purposes. Many households that purchase water still treat it for drinking, which suggests the water is, or is perceived to be, not directly potable.

Table 7. Unit prices of alternative water sources, and proportion of households treating water

Country					Household treatment (%)
	Piped from plant	Vendors	Bottled	Home boiled	
Cambodia	US\$0.07-0.34	US\$2.47-4.94	US\$43	US\$8.2-16.5	66%
Indonesia	US\$0.17	US\$5.4	US\$53	US\$21.3	90%
Philippines	US\$0.20-0.33	US\$1.0-1.6	US\$326	US\$6.2	44%
Vietnam	US\$0.155-0.50	-	-	US\$5.0-8.0	30%

Figure 6 presents the annual per capita water-related economic costs of poor sanitation. The per capita costs for water treatment for drinking is highest in Cambodia (US\$6.80). Due to Indonesia’s large population, the cost of accessing safe drinking water there dominates the four countries’ overall cost.

Figure 6. Annual per capita water-related economic costs of poor sanitation (US\$)



Whether these costs can be fully mitigated with improved sanitation depends on several factors, including the extent of water pollution from other sources, and the behavior of households in relation to perceived changes in water quality. If concern about existing water sources containing bacteria is the major driver of household water treatment, then a reduction in water pollution from human excreta could lead to significant financial and economic savings.

Because fish production is important to the countries' local economies, exports, employment and diets, the study assesses the impact of declining water quality on freshwater fish production. Declining water quality clearly affects fish production, and fish production and preparation standards affect the ability to export fish and fish

products. There are many examples of killed fish and declining fish stocks due, among other factors, to heavy water pollution and poor environmental conditions; and farmed fish often require antibiotics to fight infections from water-borne bacteria. One key indicator of water quality for fish production is the level of dissolved oxygen (DO), determined by BOD from pollutants, presence of algae, temperature, and the diurnal pattern (night/day), among others. Declining DO levels affect fish reproduction, migration and spawning patterns, and ultimately survival. Fish losses were estimated by comparing actual DO levels against optimal levels in the major rivers and lakes.

Table 8 shows the estimated US\$1 billion value of freshwater fish production in the four countries. An estimated US\$600 million is lost due to reduced DO levels in rivers and lakes. Of this, US\$173 million is attributed to poor sanitation (human excreta and gray water). The data also reflect the incomplete statistics of marketed and subsistence fish catches (see Table 6), and hence are a conservative estimate.

Table 8. Fish catch value - actual and estimated loss (US\$ million)

Country	Fish value included	Estimated fish catch value	Potential fish catch value	Attributed fish catch loss due to poor sanitation
Cambodia	All inland	223.7	292.0	44.4
Indonesia	Wild freshwater <small>Includes only fish caught in the wild</small>	330.3	779.4	92.0
Philippines	Inland fishery	85.1	114.3	9.6
Vietnam	All inland	392.7	461.1	27.4
Total		1,031.8	1,646.8	173.4

3.3 Environmental impacts

Open defecation and poorly managed latrines spoil the environment and people's enjoyment of it. Poorly managed solid waste leads to streets lined with rubbish. Decomposition of organic waste attracts flies and animals. This causes smells and poor sightlines for residents, visitors and businesses, affecting the livability and usability of land. These impacts are hard to quantify in economic terms, and few previous studies have rigorously examined the population effects of poor environmental sanitation.

In terms of the sanitation-related environmental impacts, this study focuses on solid waste management. Good practices generally consist of sanitary landfill<sup>9</sup> or sometimes incineration. These have only reached a small proportion of the population, mainly in urban areas.

In urban and rural areas, the lack of coverage of waste management services means littering is the norm, household garbage is left lying in streets, and garbage is burned, creating local air pollution. In rural areas, garbage is commonly buried in the ground. In urban areas, garbage blocks drains and ends up in rivers and lakes.

In Indonesia, even when household solid waste is collected, about 90% of the waste is disposed of illegally through open dumping. In the Philippines, an average 40% of waste is collected, with rates reaching 70% in some cities. Of the waste collected, 88% lands in open dumps or other facilities, 10% is composted, and only 2% ends up in sanitary landfills. The collection of solid waste became a national issue in the Philippines in the early 2000's, when Metro Manila's disposal sites reached capacity and were closed. In Vietnam, 12 of 64 cities have sanitary landfills. Fifty three percent of households burn their rubbish, causing air pollution and debris, while 13% throw solid waste into rivers and 19% bury it. Only 22% of households have garbage collected, mostly in urban areas. In Cambodia, waste collection does not occur in rural areas, and is relatively weak in outlying areas of cities and in unplanned settlements. Even when waste is collected, spilled rubbish lingers and streets are not cleaned.

Anecdotes from the countries suggest poor solid waste management affects citizens' welfare. Indonesians living close to the Bantargebang open dumpsite (Bekasi) were approved a monthly compensation of US\$4.50 per household for the smell they endure. In Tuba, Philippines, a household survey revealed poor solid waste management is the number one environmental problem. In Ho Chi Minh City, Vietnam, the Dong Thanh dumpsite affects residents' economic activities and water sources. In Phnom Penh, Cambodia, the Stung Mean Chey dumpsite spreads bad odors and smoggy air over a large radius.

Unsanitary dumpsites need buffer zones. This is often an unofficial measure taken because of the compromised quality of life near dumpsites. Vietnam has an official policy that a buffer zone should exist around unsanitary landfills. Land used for improper, unofficial disposal of solid waste or for open defecation will not be viable for more productive uses. This study estimates the value of land lost, using conservative land prices. Indonesia loses US\$96 million annually, and Vietnam US\$119 million.

<sup>9</sup> In Vietnam, for example, sanitary landfill requires waste accounting, waste placement, fencing, regular environmental monitoring, leachate collection and treatment. Waste pickers and animals are kept out.



ISSDP for WSP



### 3.4 Other welfare impacts

The type of a household sanitation facility has a range of impacts on population welfare. An important but difficult to quantify aspect is the impact on individuals and families that have no latrine or use a sub-standard, uncomfortable latrine. These less tangible aspects of human welfare have limited direct financial implications, and cannot be easily captured by market values. For women and girls, a private sanitary latrine with running water is particularly important, and has considerable impact on quality of life. There can be physical dangers of using distant toilets or open spaces, especially at night. In some cultures this can damage a person's status. Vulnerable groups tend to be more affected by poor sanitation, due to frailty (senior or disabled

people) or dangers (e.g. children) of poorly functioning latrines and open defecation.

Table 9 presents indicators of latrine conditions and access. Cambodia has among the worst latrine access in the world, with over two-thirds of the population practicing open defecation. In Indonesia, 40% of the population practices open defecation or uses shared latrines. The proportion is 27% in Vietnam, and 6% in the Philippines. For these populations, considerable challenges exist to wash hands with soap after defecation, thus contributing to the spread of fecal-oral diseases.

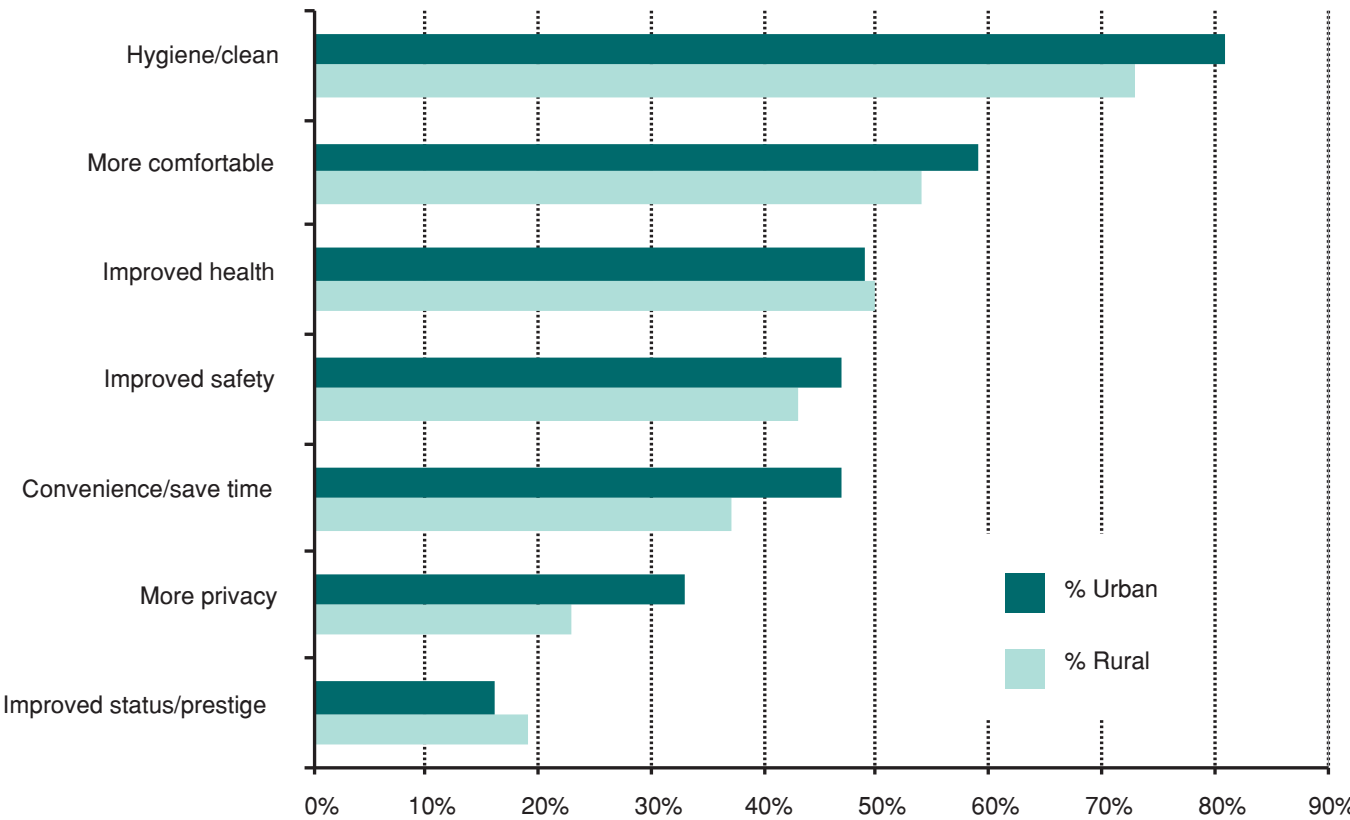
Table 9. Indicators of latrine conditions and access (millions), latest data

Country	Population (millions)		Average access time (minutes/day)		Economic loss (US\$ million)
	No latrine (open defecation)	Shared toilet facilities	No latrine (open defecation)	Shared toilet facilities	
Cambodia	9.8	0.63	10	3	38.2
Indonesia	22.2	15.7	15	15-30 <sup>1</sup>	1220.0
Philippines	9.1	15.2	5	5	24.5
Vietnam	2.2	3.1	10	15	41.6
Total	50.2	44.9	-	-	1324.3

<sup>1</sup> 15 minutes in rural areas, and at least 30 minutes in urban areas due to overcrowding (low toilet per population ratio).

Household surveys of latrine preference are uncommon. Figure 7 shows the perceived importance of an improved latrine to households in 3 rural and 3 urban areas of Cambodia<sup>10</sup>. Among the sampled households, more than 80% of urban and 70% of rural households recognized an improved latrine would provide better hygiene and a generally clean living environment. Comfort, health improvement, safety, and convenience are other important perceived benefits. Privacy, improved family status and prestige are cited as other advantages of having an improved latrine at home.

Figure 7. Perceived importance of improved latrine to households in Cambodia



In Vietnam a survey conducted in 2002 showed that 7 of 12 focus groups considered reputation with neighbors and guests as a motivating factor to build a latrine<sup>11</sup>. Households are motivated by the desire to be considered modern, save face with guests, and get respect from neighbors.

People with no latrine or sub-standard latrines spend time traveling to open defecation sites or public latrines, or waiting in line for insufficient shared or public latrines per capita. This time spent has an economic value because it could be used for other productive or leisure activities. In the countries studied, the total annual economic value of time lost is US\$1.3 billion (Table 9). This measures the time to visit a defecation site once daily and does not include urination, which adds further time loss, especially for women who seek more privacy than men. The hourly time value of time spent accessing latrines equals 30% of average income for adults, and 15% for children.

The condition or absence of latrines in institutions also affects people's ability to go to school or work. A significant proportion of schools do not have latrines. Almost a third of Cambodian schools, and half of Vietnamese schools lack latrines. Water supply is lacking in 40% of Cambodian schools and 34% of Philippine schools. Even if schools have toilets, consultant and media reports indicate there aren't enough toilets, or they have poor technical standards, maintenance and sanitary conditions. Many workplaces also lack adequate water and sanitation, affecting time use, productivity, and employment decisions, especially of women.

Poor sanitation in schools contributes in part to a student's decision not to enroll or to drop out, especially for menstruating girls. The heightened transmission of disease due to poor school sanitation leads to absences. For all pupils and teachers, inadequate latrines cause significant discomfort and inconvenience.

<sup>10</sup> Demand assessment for sanitary latrines in rural and urban areas of Cambodia. 2007. Water and Sanitation Program, World Bank.

<sup>11</sup> Selling Sanitation in Vietnam - What works? 2002. Water and Sanitation Program, World Bank.

3.5 Tourism impacts

Tourism is an important source of income, employment and foreign currency in all four countries. The contribution of tourism to GDP varies from 1.7% in the Philippines, to 5% in Indonesia and Vietnam, to 14.6% in Cambodia. Fourteen million foreign tourists visited the countries in 2005, generating US\$10.5 billion in revenue. The countries also had about 150 million domestic tourists.

No previous studies have examined the link between tourism and sanitation conditions, although in many developed countries medical and tourist organizations monitor the diseases contracted by travelers returning home. Thus 'high risk destinations' are known for specific diseases, including dengue fever, parasites, severe acute respiratory syndrome (SARS), respiratory and diarrhea-related diseases.

Unarguably, the popularity of tourist destinations is partially related to a country's sanitary conditions. Whether tourists can expect private, hygienic, and culturally appropriate toilet conditions, and running water and soap, will play a role in determining their choice of holiday destination. Furthermore, tourists' perceptions and experiences of broader sanitation aspects will contribute significantly to their choice

of destination and whether they return. These include food safety, health events, sights and smells of the immediate environment, and the cleanliness of water for swimming. Also, with an ageing tourist population, the needs and preferences of senior people who are more sensitive to their environment will play an increasing role in tourist standards.

Tourist hotel occupancy rates are far from optimal levels in most of the four countries, ranging from an average 45% in Indonesia to 70% in Vietnam (see Table 10). All countries could further exploit existing tourist capacity to generate significantly greater revenues at relatively little extra cost. Improved sanitation would help attract more tourists. This study estimates current economic losses, based on the premise that occupancy rates are below the optimal rate due in part to poor sanitation. Poor sanitation is assumed to account for 5% of the attributed losses. In Cambodia, stakeholders considered sanitation more important than in other countries, justifying the use of a 10% attribution to tourism losses there. Based on these assumptions, the annual economic losses are estimated at US\$348 per annum. Table 10 shows the losses by country.

Table 10. Economic impact of lower tourist numbers

Country	Current tourism value (US\$ million)	Hotel occupancy rate		Potential value (US\$ million)	Attribution to sanitation	Sanitation-attributed annual economic losses and potential gains (US\$ million)
		Current	Target			
Cambodia	1,049	54.8%	80%	1,786	10%	73.7
Indonesia	4,450	45.0%	90%	7,776	5%	166.0
Philippines	1,784	61.0%	90%	2,589	5%	40.1
Vietnam	3,200	70.0%	90%	4,571	5%	68.6
Total	10,483	-	-	17,722		348.4

With the improvement of sanitation, it is expected that sustainable tourist growth will continue and significant economic returns will be generated.

3.6 Overall economic impacts

The total economic impact of poor sanitation in the four countries is an estimated US\$9 billion a year, based on 2005 prices. This is 2% of combined GDP, from 1.3% in the Philippines and Vietnam, to 2.2% in Indonesia to over 7% in Cambodia (see Table 11).

Indonesia suffered 71% of overall losses, partly because of its large share of the population (54%) among the countries (Figure 8). Annual per capita losses range from US\$9.30 in Vietnam, US\$16.80 in the Philippines, US\$28.60 in Indonesia and US\$32.50 in Cambodia (Figure 9). Countries with the least sanitation coverage have significantly higher per capita losses. Health and water impacts are the largest contributors to overall cost. The health costs are dominated by premature death, while water-related costs are dominated by access to clean drinking water (Figure 9).

Figure 8. Overall annual economic losses and gains (in US\$ million)

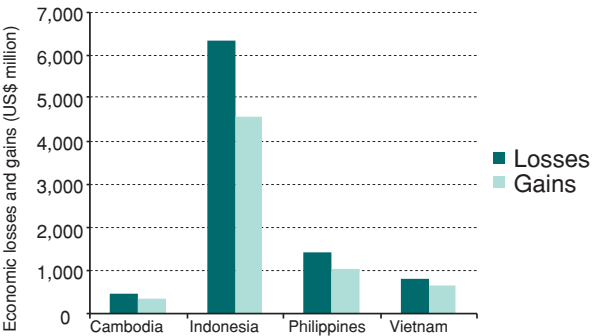
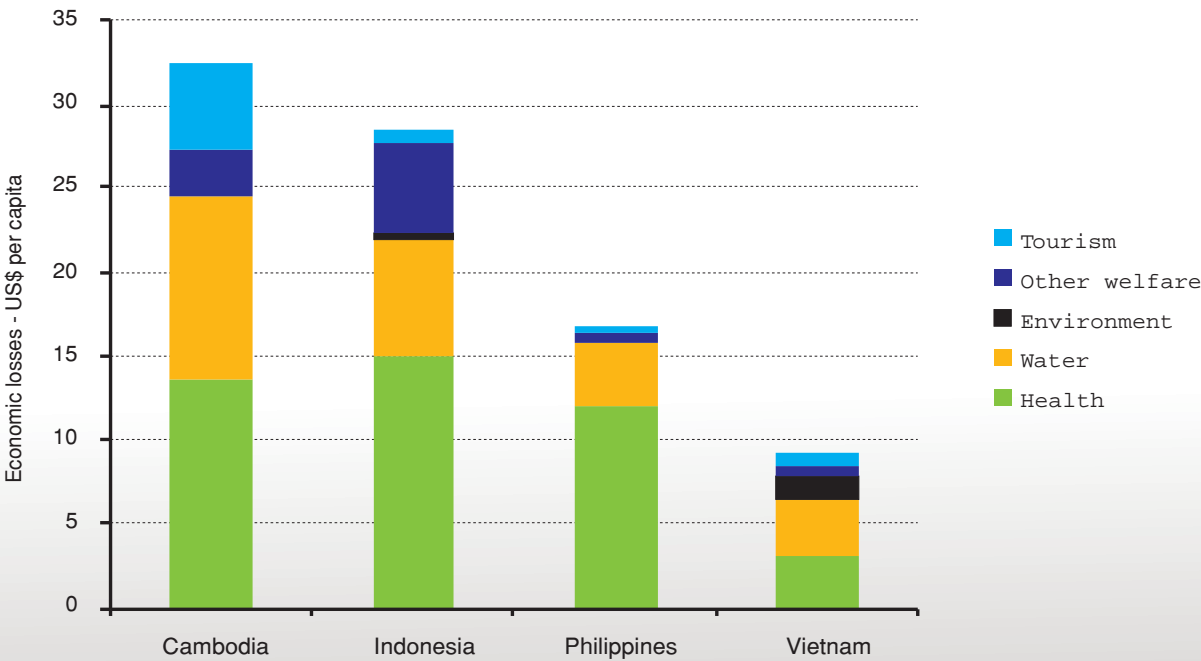


Figure 9. Annual per capita losses, by impact (US\$)





Because the US Dollar has different purchasing power in the four countries, the US Dollar values were converted to International Dollars (I\$) - a common currency that adjusts price differences using purchasing power parity exchange rates. This conversion allows the comparison of relative costs to the local economies, as well as cross-country comparisons. (See Table 11).

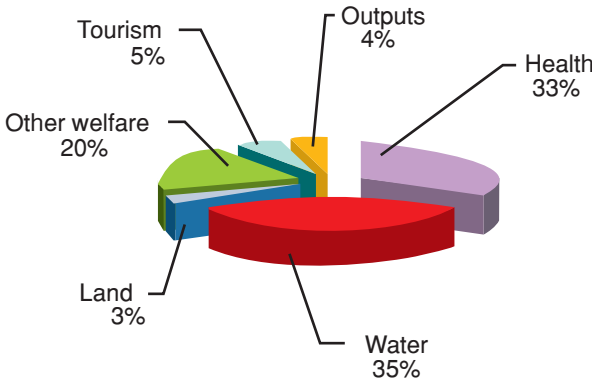
Table 11. Economic costs in US Dollars and International Dollars, compared with GDP

Country	United States Dollars (US\$)			International Dollars (I\$)			Impact compared to GDP (%)
	Total impact (US\$ million)	% total	Per capita impact	Total impact (I\$ million)	% total	Per capita impact	
Cambodia	\$448	5%	\$32.5	\$2,733	9%	\$198.0	7.2
Indonesia	\$6,344	71%	\$28.6	\$17,763	59%	\$80.0	2.3
Philippines	\$1,412	16%	\$16.8	\$5,931	20%	\$70.4	1.3
Vietnam	\$780	9%	\$9.3	\$3,744	12%	\$44.5	1.3
Total	\$8,984	100%	\$22.2	\$30,171	100%	\$74.7	2.0

Improved sanitation yields an estimated US\$6.6 billion in economic gains (Figure 10). There is some uncertainty in these estimates, given the difficulty of predicting which costs are mitigated and which are not, and over what time period. The water losses mitigated, which contribute to 35% of the overall gains, are dependent on other factors such as changes in water treatment practices. Because many economic losses were not quantified in this study, the economic gains could be considered conservative.



Figure 10. Distribution of economic gains from improved sanitation, by impact



# Recommendations

The following four policy recommendations are based on this study's major findings:

**Major finding 1.** Poor sanitation causes approximately US\$9 billion in annual economic losses in the four countries, an average of 2% of annual GDP. A greater share of the socio-economic burden of poor sanitation falls on the population without improved sanitation - especially women, children, the senior population and the poor - making worse inequities in society. By improving sanitation, a significant proportion of these socio-economic impacts can be mitigated.

**Recommendation 1.** Decision-makers are advised to act now. Governments and other stakeholders should jointly reassess the current and planned spending levels on sanitation and related sectors, covering health, water resources, environment, rural and urban development, fisheries and tourism. Sanitation should be given increased political importance and budget allocations. Governments should give priority to the populations with no latrines.

**Major finding 2.** The health- and water-related impacts of poor sanitation have the greatest economic toll on society. This study confirms that the most tangible impact of poor sanitation is an increased risk of infectious disease and premature death, which result in high economic costs. A high proportion of human excreta and wastewater eventually finds its way to water bodies and causes significant pollution and related economic costs.

**Recommendation 2.** Governments should focus on the easily achieved health benefits of improved sanitation - by educating children and promoting safe but simple low cost latrine designs, improved excreta isolation measures and improved hygiene practices such as hand washing with soap. Governments should urgently implement sanitation standards that reduce the release of waste matter into water resources. Focus should not be just on human excreta, but also solid waste, household, agricultural and industrial waste, which affect health and pollute water resources.

**Major finding 3.** Sanitation has a major role in sustainable development, due to its multiple impacts and links with other development goals (MDGs). Sanitation plays a key but largely unrecognized role in population welfare and poverty reduction. Impacts not fully explored in this study - in particular tourism and the investment climate - are potentially major arguments for improving sanitation.

**Recommendation 3.** Sanitation cannot be the task of a single sector or ministry, nor of a single level of government. Clear roles and responsibilities need to be defined. The development of a policy and regulatory framework for environmental and health protection should

be prioritized. Advocacy is needed at the highest levels to ensure political support and resource allocations for sanitation, but also at implementation levels where population demand for sanitation is key for its success.

**Major finding 4.** The socio-economic impact of poor sanitation varies between different countries. This study presents crude but realistic estimates of economic impacts at the national level. Given the lack of sanitation-related information in official reporting systems and surveys, several impacts of poor sanitation could not be evaluated, or assessed at the local level.

**Recommendation 4.** To convince local decision-makers - from city mayors or provincial governors down to households - local studies would be more credible in showing the real impacts of sanitation affecting their population, and obtained improvements in population welfare. The methodology used in this study can be applied at any level. Further research studies could fill important knowledge gaps about the economic and welfare effects of improving or not improving sanitation.



Indonesian local artisans

Economic losses due to poor sanitation, by impact

Country and impact	Economic losses		
	US\$ million	Per capita	%
Cambodia	448.0	32.4	100%
Health	187.1	13.6	42%
Water	149	10.8	33%
Other welfare	38.2	2.8	9%
Tourism	73.7	5.3	16%
Indonesia	6,344.0	28.6	100%
Health	3,350.0	15.1	53%
Water	1,512.0	6.8	24%
Environment	96.0	0.4	2%
Other welfare	1,220.0	5.5	19%
Tourism	166.0	0.7	3%
Philippines	1412.1	16.8	100%
Health	1011.1	12.0	72%
Water	323.3	3.8	23%
Other welfare	37.6	0.4	3%
Tourism	40.1	0.5	3%
Vietnam	780.1	9.3	100%
Health	262.4	3.1	34%
Water	287.3	3.4	37%
Environment	118.9	1.4	15%
Other welfare	42.9	0.5	6%
Tourism	68.6	0.8	9%
TOTAL	8,984.2	22.2	100%

ABBREVIATIONS

BOD	Biochemical Oxygen Demand	JMP	Joint Monitoring Programme (WHO, UNICEF)
DO	Dissolved Oxygen	Kg	Kilograms
EAP	East Asia and the Pacific	MDG	Millennium Development Goal
ESI	Economics of Sanitation Initiative	NGO	Non-Governmental Organization
GDP	Gross Domestic Product	UNICEF	United Nations Children's Fund
HCA	Human Capital Approach	WHO	World Health Organization
HH	Household	WSP	Water and Sanitation Program

